We claim:

1. An optical apparatus comprising:

a polarization splitting element, with an input port and first and second output ports, where the polarization splitting element splits the orthogonal components of a received input signal into first and second output signals directed to the respective first and second output ports,

a first waveguide with an input port and an output port, where the input port is coupled to the first output port of the polarization splitting element, and

a second waveguide with an input port and an output port, where the input port is coupled to the second output port of the polarization splitting element,

where the first and second waveguides are substantially identical and where the second waveguide is adjacent to the first waveguide on a substrate.

2. An optical apparatus according to claim 1, wherein the polarization splitting element splits the orthogonal components of the received input signal into substantially identically polarized first and second output signals directed to the respective first and second output ports.

3. An optical apparatus according to claim 1, and further comprising: directing the output of the first waveguide to the input port of a first signal processing system, and

directing the output of the second waveguide to the input port of a second signal processing system,
where the first and second signal processing systems are substantially identical and where the second signal processing system is adjacent to the first signal processing system on a substrate.

4. An optical apparatus according to claim 1, wherein each of the first and second signal processing systems is comprised of one of the following:
a plurality of wavelength demultiplexers,
a plurality of modulators,
a plurality of waveguides
and
a group comprised of:
a plurality of waveguides,
a plurality of photodetectors and
a plurality of transistors.

5. An optical apparatus according to claim 1, wherein each of the first and second signal processing systems is comprised of a wavelength dependent filter with a plurality of outputs that impinge on a plurality of photodetectors, and where the signals from the first signal processing system and second signal processing system are processed in the electronic domain to generate a signal that does not exhibit polarization dependence.

6. An optical apparatus according to claim 5, wherein the first and second signal processing systems are monolithically fabricated on a silicon substrate.

7. An optical apparatus according to claim 5, wherein the first and second signal processing systems are monolithically fabricated on a single silicon on insulator (SOI) substrate.

8. An optical apparatus according to claim 1, wherein the polarization splitting element and the first and second waveguides are disposed on a single substrate.

9. An optical apparatus according to claim 1, wherein the second waveguide is disposed less than one autocorrelation length from the first waveguide.

10. An optical apparatus according to claim 1, wherein the first and second waveguides each support only a single mode of a single polarization.

11. An optical apparatus according to claim 10, wherein the first and second waveguides each support only a TE mode.

12. An optical apparatus according to claim 10, wherein the first and second waveguides each support only a TM mode.

13. An optical apparatus according to claim 1, wherein the first and second waveguides are oriented along the same propagation axis.

14. An optical apparatus according to claim 1, wherein the first waveguide has a plurality of cladding regions and the second waveguide has

a plurality of cladding regions, wherein the first and second plurality of cladding regions are substantially identical.

15. An optical apparatus according to claim 1, wherein the output from the first and second waveguides impinge on a single photodetector.

16. An optical apparatus according to claim 3, wherein a first optical system is comprised of the first waveguide and the first signal processing system, and a second optical system is comprised of the second waveguide and the second signal processing system,
where the first and second optical systems are substantially identical and comprise a substantially matched pair of optical systems.

17. An optical apparatus according to claim 16, wherein each optical system of the substantially matched pair of optical systems has a plurality of output ports.

18. An optical apparatus according to claim 17, wherein each of the plurality of output ports of the substantially matched pair of optical systems impinge on a single photodetector.

19. An optical apparatus according to claim 18, wherein the following are monolithically integrated on a SOI substrate:

a grating coupler,
with an input port for receiving an optical input signal, and first and second output ports, where the grating coupler splits the orthogonal components of a

received input signal into first and second output signals directed to the respective first and second output ports,

a substantially matched pair of optical systems,
with first and second input ports coupled to the respective first and second output ports of the grating coupler, and with a first and second plurality of output ports,
and
a photodetector,
with a plurality of input ports coupled to the first and second plurality of output ports of the substantially matched pair of optical systems, and with a single electrical output port.

20. An optoelectronic integrated circuit comprising:

a grating coupler with an input port for receiving an optical input signal, and first and second output ports, where the grating coupler splits the orthogonal components of a received input signal into first and second output signals directed to the respective first and second output ports,

a first waveguide with an input port and an output port, where the input port is coupled to the first output port of the grating coupler,

a second waveguide with an input port and an output port, where the input port is coupled to the second output port of the grating coupler,
where the first and second waveguides are substantially identical and where the second waveguide is adjacent to the first waveguide,

a first signal processing system with an input port and a plurality of output ports, where the input port is coupled to the output port of the first waveguide,

a second signal processing system with an input port and a plurality of output ports, where the input port is coupled to the output port of the second waveguide,
where the first and second signal processing systems are substantially identical and where the second signal processing system is adjacent to the first signal processing system,
and
a photodetector, with a plurality of input ports coupled to the pluralities of output ports of the first and second signal processing systems, and with a single electrical output port.

21. A maskwork used for fabricating a substantially matched pair of optical paths, where the optical paths are oriented along the same propagation axis.

22. A maskwork used for fabricating a substantially matched pair of optical paths, where each of the optical paths includes a waveguide, and each optical path contains substantially identical elements within proximity to the waveguides.

23. A maskwork used for fabricating a substantially matched pair of optical paths, where each of the optical paths includes a waveguide, and

each optical path contains substantially identical CMOS tiling and fill structures within proximity to the waveguides.